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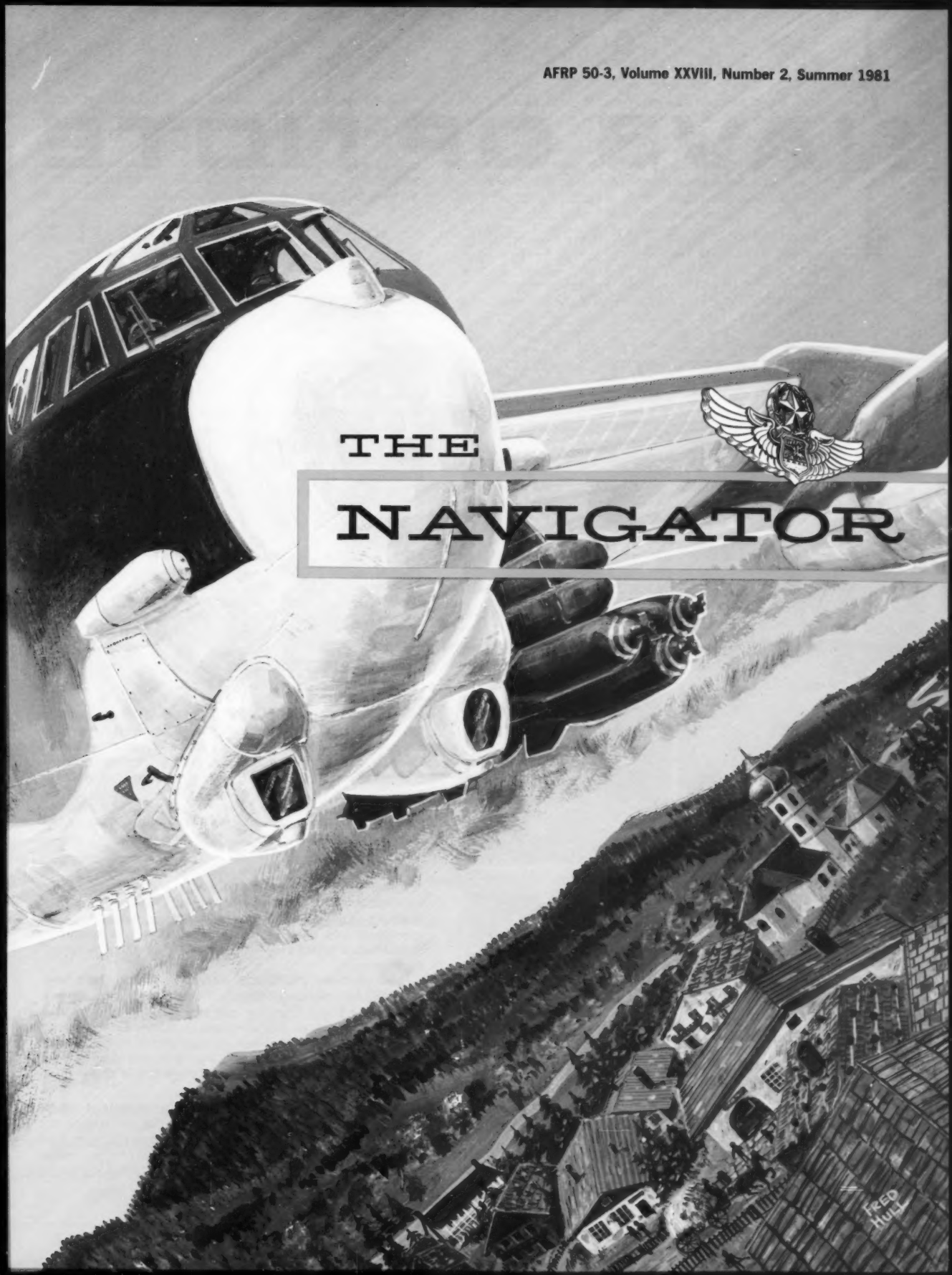

THE NAVIGATOR

NAVS OF NOTE

Colonel Quentin C. Smith is the Deputy Commander for Operations, 323d Flying Training Wing, Mather Air Force Base, California. In this capacity, he directs navigator training operations for all US military services. In addition to training US Air Force, Navy and Marine navigators, he is also responsible for training navigators from many allied nations. His training force, the largest in Air Training Command, consists of seven flying squadrons and five divisions. This complex not only conducts Undergraduate Navigator Training (UNT) but also training for navigator bombardiers, electronic warfare officers, instructor navigators, and instructor pilots. In addition, his instructors provide Tactical Navigation or Advanced Navigation training to UNT graduates. Colonel Smith assumed his position at Mather in June 1980, following a tour of duty at Headquarters USAF.

Born in Natural Bridge, New York, Colonel Smith graduated from Clarkson College of Technology with a bachelor of science degree in Industrial Distribution. Following a year with the General Dynamics Electronic Division, he entered OTS, earning his commission in August 1960. He was awarded his navigator wings at Harlingen AFB in 1961 and graduated from navigator bombardier training at Mather AFB in 1962. For the next three years he remained at Mather as a navigator bombardier instructor.

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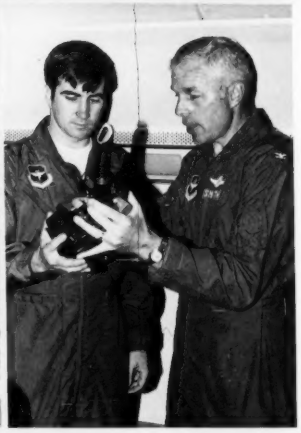

In 1965, Colonel Smith was assigned to exchange duty with the Canadian Air Force at CFB Winnepeg, Manitoba, where he was first a student and then a staff officer with the Canadian Forces Aerospace Systems Course, a one-year course of study designed to prepare selected Canadian officers for weapon system specification, development, and procurement jobs.

Following his exchange tour, Colonel Smith attended Stanford University under the Air Force Institute of Technology program, graduating in January 1970 with a MS in Industrial Engineering.

Recognizing the value of combat experience, he then upgraded in the EB-66 and was assigned in 1970 to the 42d Tactical Electronic Warfare Squadron, Takhli RTAFB, and later, Korat RTAFB, Thailand. During his one-year tour he was credited with 175 combat missions and over 600 combat hours. He returned from Thailand to attend the Armed Forces Staff College, graduating in January 1972.

Colonel Smith was then assigned to the Sacramento Air Logistics Center as an industrial engineer in the Directorate of Maintenance. He served in this capacity, specializing in the depot maintenance of the F-111, F-106, and F-100, until 1974 when he returned to flying duty as an F-111E WSO in the 20th Tactical Fighter Wing, RAF Upper Heyford, United Kingdom. In 1975, he became the first navigator squadron operations officer of a USAF tactical fighter squadron. "That job was surely the most exciting and challenging of my career, especially since I was one of the first to have such an opportunity. It is rewarding to know that now dozens of navigators are excelling as flight commanders, operations officers and squadron commanders in flying squadrons with combat missions, particularly so in our tactical forces."

In his last year at Upper Heyford, Colonel Smith commanded the 20th Field Maintenance Squadron. In 1977, he returned to the United States to attend the Industrial College of the Armed Forces. Upon graduation, he was assigned to Headquarters USAF, Washington, DC, where he served as a member of the Air Force Long Range Planning Study Group and as Chief of the Planning and Integration Division, Directorate of Plans. His division's responsibilities included assisting the Secretary of the Air Force and Chief of Staff in long range objective formulation for the Air Force.

Taking a long range view, Colonel Smith believes that navigator-trained officers will be vital to the Air Force for the foreseeable future. "Not only are many current weapon systems, requiring some variant of a navigator, programmed to remain operational into the 90s, but a prospective new multi-role bomber would create a market for navigators through the turn of the century."

About command positions for navigators, Colonel Smith views the future with cautious optimism. "Flying command opportunity has improved and, I believe, will slowly continue to as wing commanders discover that flights and squadrons run as well with a good navigator at the helm as with a good pilot. I am convinced that many of the young navigators leaving Mather today possess the potential for command. We teach them to take charge more so than when I was a student."

"We can all help expand the role of the navigator in the Air Force by leaving behind the parochial grousing and seeking out those jobs that will groom us for future leadership positions. Start small, but think BIG!"

Lieutenant Colonel Donald Emmons is the Operations Officer of the 1st Strategic Reconnaissance Squadron, Beale AFB, California. His unit is the only Air Force organization to fly the Mach 3 SR-71 "Blackbird."

A 1964 graduate of Coe College in Cedar Rapids, Iowa, Colonel Emmons entered the Air Force in October 1964, through the ROTC program. He attended Nav School at James Connally AFB, followed by NBT at Mather. Eight years of B-52 duty followed at Dyess AFB, Texas, during which Colonel Emmons progressed through Stan Eval as a nav and a radar nav. He accumulated 3,500 hours B-52 time as well as flying 220 Arc Light missions in Southeast Asia. Colonel Emmons attended SOS in residence, and earned a master's degree in Business Administration in 1974.

In August 1974, Colonel Emmons was selected to join the Air Forces' only SR-71 unit and spent the next six years flying this fast, sophisticated bird on a variety of missions both stateside and overseas. "The SR job is fascinating for a navigator. There is a lot of TDY, and as the OPS Officer, a constant challenge to manage a limited number of aircrews under sometimes difficult circumstances."

Colonel Emmons has amassed over 700 hours in the SR-71. During his last two years on a crew he served as the Chief of Recon Nav Branch, Stan Eval. In August 1980, he was selected to become the Operations Officer and is one of the relatively few SAC navigators to hold this position. Relating some of his experiences, Colonel Emmons said, "I took over as the Ops Officer, and 10 days later the Squadron Commander left on a six week TDY. Suddenly, I was in total command at the home base, and that was quite an introduction to the job. I learned very quickly the responsibility of running the daily routine of a very valuable resource, and am fortunate to have a bunch of super people working with me. The SR is a fantastic assignment, and I am extremely fortunate to have this opportunity."

Colonel Emmons is an advocate of pursuing PME and higher education and has a squadron program to track and encourage his crew members to attain such. "The opportunities are there, both financially and availably. They are the one promotion factor over which you have complete control, and they are invaluable to you as an Air Force officer/supervisor and as a future civilian." While at Beale he has completed ACSC, ICAF, and AWC by correspondence and attained another master's degree in Systems Management. Colonel Emmons believes that the route from crew member up is the best way to learn the in-depth workings of a flying organization. "You really see the whole show, from the crew's viewpoint, scheduling, maintenance, the works. The TDY trips with this organization are great, in that the Squadron Commander/Ops Officer serves as the director of operations. You essentially run the show while overseas."

The 1 SRS is always looking for good people, and when asked the desirable qualities for an SR-71 nav, he said, "We look for qualified folks who have a high degree of airmanship, who enjoy a challenging job and who can have absolute trust and confidence in their fellow crew members. This job is well worth the necessary sacrifices, and our aircraft system is the finest in the world." Colonel Emmons advises new navigators to "gain as much experience as possible in your job, learn all aspects of the systems you work, and constantly strive to improve yourself. If you do, you won't be disappointed."

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Perhaps the B-52Hs on our cover are flying a route developed by SAC's 1st Combat Evaluation Group. Details on this interesting job begin on the following page.

For a behind-the-scenes look at sextant repair and usage, see page 26.

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Distribution: One copy per two navigators.

SAC route and target development

Lieutenant Colonel Claude E. RIGGS, Jr.
1 CEVG
Barksdale AFB, LA

Headquartered at Barksdale AFB, Louisiana, the 1st Combat Evaluation Group (1 CEVG) is the home office for a group of professionals who provide a vital service to the military air mission. Bombers utilize their services and encounter them on most sorties. RECCE and Guard aircraft fly against them. Numerous tanker sorties terminate navigation legs with them. That Radar Bomb Score, missile miss distance, orbit exercise score, navigation score, passive Electronic Countermeasures, or Wild Weasel attack was provided by this group.

The 1 CEVG has an authorized strength of about 1,200. Our commander reports directly to the HQ SAC Deputy Chief of Staff for Operations, and we are functionally controlled by the HQ SAC Director of Training. The 1 CEVG commander has a special staff comprised of a Headquarters Squadron Commander, Administrative Division, Analysis and Special Projects Division, Safety Division, Comptroller, Historian, and Training Section. Additionally, two deputates work directly for the 1 CEVG/CC: the Deputy Commander for Standardization and Evaluation, and the Deputy Commander for Radar Bomb Scoring.

Most people associate 1 CEVG with the standardization/evaluation side of our house. These are the flying experts who visit SAC wings, Reserve, and Guard units to determine how well they fly and administer their unit stan/eval programs. Over 75 percent of the 1 CEVG personnel, however, are under the supervision of the Deputy Commander for RBS. The RB, as we refer to him, has 25 officers, 90 airmen, and civilians in his group headquarters staff. He has an administrative section, staff assistance section, and three divisions (Operations, Communications Electronics Maintenance, and Radar Bomb Development). The RB is responsible for the effectiveness, efficiency, and overall capabilities of all Radar Bomb Scoring, Electronic Countermeasures, and Ground Directed Bombing facilities in the Strategic Air Command. Scattered throughout 16 CONUS and 3 overseas Strategic Training Range (STR) sites are the remaining people of 1 CEVG. RB directs this far flung unit by written and telephonic policies. Periodic visits provide the personal leadership contact.

Eleven of our CONUS STRs are permanent installations (see Figure 1). Some of these units have been in position over 20 years. Larger detachments have about 90 Air Force and civilian personnel assigned, while smaller ones are manned by approximately 45 personnel. Three fixed sites are located in Germany, Guam, and Korea.

Figure 1

Permanent STR detachments are commanded by either rated navigator or electronic warfare officers. These A2225Ys or A2275Ys are usually lieutenant colonels and function the same as Base Commanders for isolated installations.

Five of our sites are Mobile Duty Locations. These are made up of 9 to 11 towable vans and are manned by 17 to 25 TDY personnel from the permanent detachments. Mobiles are relocated annually to provide scoring for special "first look" missions (Operations Readiness Inspections, Bombing and Navigation Competitions, and Global Shields). Mobile Duty Locations are commanded by one of the fixed site commanders or senior NCOs.

The Low Level Route and Strategic Training Range story actually begins in the Radar Bomb Development Division and its three branches (Route Development, Site Development, plus Targeting and Survey). SACs low level routes and scoring facilities are available and used by other DOD agencies and many allied aircrews.

ROUTE DEVELOPMENT

In the initial stages of SAC route and target development, a Route Development Officer begins feasibility studies 470 days before a low level route with scoring facility opens. Route Development is the centralized low airspace management office for all of SAC and each route must satisfy joint USAF/FAA operating agreements and HQ SAC directives.

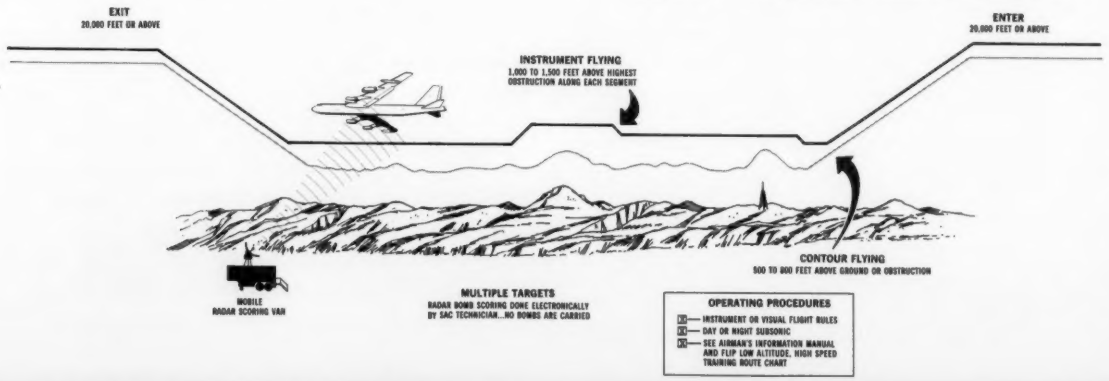
The first 40 days are spent laying out a route and selecting possible bombing maneuver areas. Military and civilian flying operations must be considered. Airports, towers, special use airspace, and environmentally sensitive areas all affect route location and direction. Proposed routing is sent to other MAJCOMs, Reserve, and Guard forces for possible conflicts. Approval is received from appropriate HQ SAC offices and environmental impact studies are initiated. At this stage, the new route is only a coordinated and negotiated series of leg segments developed to provide as much navigation realism and bombing challenge as peacetime safety will allow.

At the 430 day point, a joint SAC/FAA Conference is called to solve remaining route conflicts. Two 1 CEVG Route Developers represent SAC. Immediately following this conference the developers begin an 8 to 10 day trackwalk (this term remains from the "old days," when mobile radar sites were on railroad cars).

During the trackwalk, these officers will drive a GSA vehicle 2,000 to 4,000 miles in, around, and through each prospective bombing maneuver area. They locate environmentally sensitive ground operations (cattle feeders, chicken/turkey farms, dairies, mink and fox farms, wildlife refuges, nesting/feeding areas for waterfowl or migratory birds, etc). They also note any complexes that may furnish usable radar returns (aimpoints) for the aircrews. Finally, they evaluate locations for scoring sites. Power, telephone, fire protection, motel availability and, not least, radar tracking capabilities are all entering arguments in these evaluations.

The next 85 days are spent revising maneuver areas, coordinating route changes and rewriting route descriptions. Two developers will then charter a light aircraft (Civil Air Patrol, if available) and conduct a low and slow obstruction survey of the entire route (centerline to corridor limit). Preparation for the "bug" trip will also be in full swing during this period. Our Site Development Transportation Officer arranges all movements of personnel and equipment for this trip.

Figure 2 **TYPICAL LOW LEVEL TRAINING ROUTE**


EXIT
20,000 FEET OR ABOVE
ENTER
20,000 FEET OR ABOVE
INSTRUMENT FLYING
1,000 TO 1,500 FEET ABOVE HIGHEST OBSTRUCTION ALONG EACH SEGMENT
CONTOUR FLYING
500 TO 800 FEET ABOVE GROUND OR OBSTRUCTION
MOBILE
RADAR SCORING VAN
MULTIPLE TARGETS
RADAR BOMB SCORING DONE ELECTRONICALLY BY SAC TECHNICIAN...NO BOMBS ARE CARRIED
OPERATING PROCEDURES
— INSTRUMENT OR VISUAL FLIGHT RULES
— DAY OR NIGHT SUBSONIC
— SEE AIRMAN'S INFORMATION MANUAL AND FLIP LOW ALTITUDE, HIGH SPEED TRAINING ROUTE CHART

A "bug" trip is a radar capabilities tracking test. Our mobile radar team, composed of maintenance, operations, and two route development officers, will deploy to the prospective scoring sites for verification flight tests. The "bug" (Mobile Tracking Bomb Scoring Radar) supported by a diesel powered electrical van will be positioned at the candidate site to monitor and direct tracking of a B-52 and FB-111 aircraft. Bombers are flown by 1 CEVG Stan/Eval crews. Effects of radar masking at instrument and visual altitudes, target combination capabilities, and route obstructions are annotated on the "bug" radar plotting paper. Test data will be returned to the Development Division. Operations division experts and our two targeting officers will review all test results before making tentative recommendations to the Deputy Commander for RBS. During the bug trip, our site development engineer, accompanied by an Army Corps of Engineers representative, has been working land leases and utilities support for prospective site locations.

At the 340 day point, Targeting and Survey has received the bug traces, aircraft radar film, charts, and all necessary working material. For the next 150 days, targeting officers will study material, including vertical photography, and secure HQ SAC approval for recommended targets and tactics. A geodetic survey team will deploy to determine precise positioning for scoring radars, equipment van stakeout, calibration targets, and fly-in points. After SAC approval, all target and route information will be released to the bomb wings (150 days before vulnerability).

Meanwhile, Site Development has been negotiating host tenant support agreements (HTSAs) with the military installation nearest the sites. They have completed actions with HQ SAC real estate and the Corps of Engineers for land leasing. Utility contracts and telephone hookups have been coordinated. Site environmental studies have been completed and approved. Transportation arrangements have been made with commerical haulers to move about 20 radar and support vans and Government bills of lading issued. Site construction contracts have been executed.

Route Development and Targeting have been making plans for the dynamic radar equipment fly-in, the final route obstruction flight, and the B-52/FB-111 operational flight check.

Physical tear down at the old mobile location starts 45 days before route opening. Transportation will monitor and coordinate van movements and parking sequences. Site Development's CE section will construct all weather van interconnects and access stairs to tie the mobile site together. Vans will be skirted and the flagpole raised. MDL commanders and key staff members will arrive early to monitor contracts, handle petty cash purchases, and aid in the construction. Operations and Maintenance crews show up about 20 days before opening to start bringing up the radar/ECM equipment.

Two route development officers, in a chartered light aircraft, will again fly the entire route looking for new uncharted towers and any other possible flight obstructions. Environmentally sensitive areas that could cause overflight complaints are top items of interest.

Fifteen days before route opening a group headquarters maintenance assist team will deploy to aid in bringing up scoring equipment. After the radars are powered and calibrated, the route developers will fly in the light aircraft over surveyed points. Surveyors using vertical transits will score the accuracy of the site ground direction efforts. This dynamic equipment flight confirms both geodetic survey computations and the scoring radars accuracies.

At the 10-day point a B-52 and FB-111, again crewed by 1 CEVG Stan/Eval personnel, will fly the entire low level route and attack the bombing maneuver areas utilizing the targets and tactics the bomb wing will employ. After this operational route and site check we're ready for the first customers.

Our new Mobile Duty Location will be manned for 6 to 12 months. Development actions described above will be repeated five times each year. Over 150 separate and critical checklist action items are necessary during the 470 day development effort. Most of the work is highly sensitive and is kept in-house (HQ 1CEVG) to preserve the command's "first look" concept. Our bomb wings and aircrews must have these challenges to help maintain combat readiness. Our job is dynamic and visible throughout the Strategic Air Command and we're proud of our contribution to peace. That is still our profession.

Lt Col Riggs entered the Air Force in 1956 via ROTC at Memphis State University. He accrued 10 years crew duty as a B-52 navigator and radar navigator before serving as Chief of Bomb Nav at Barksdale AFB. Assigned to SAC headquarters, he was Chief of Bomb Nav, Director of Training, and DCS/Operations. Col Riggs now is Chief, Radar Bomb Development, Barksdale AFB.

A DECENT DESCENT

Captain W. Jay SCHELL
916 AREFS
Travis AFB, CA

The flying business guarantees the aviator will, one way or another, come down. This article discusses descent techniques and associated mathematics for the navigator.

Descent mathematics apply to any aircraft and involve using the "1 in 60" rule in the vertical plane. The "1 in 60" rule stipulates that a 1° deviation over 60 nautical miles (nm) will result in a 1 nm displacement. Thus, if an aircraft followed a 1° angle of descent for 60 nm, it would lose 1 nm (6,076 feet) of altitude (Fig 1). Reducing the size of Fig 1 by 1/60 shows (in Fig 2) that a 1° angle of descent indicates 100 feet of altitude lost over a distance of 1 nm, a 2° angle loses 200 feet per nm, a 2.8 degree angle loses 280 feet per nm, etc. This altitude loss, called the descent gradient, will have a significant role in calculations for start and visual descent points plus rates of descent.

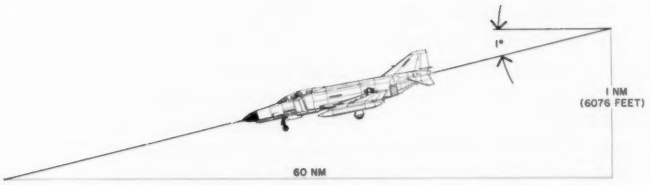


Figure 1

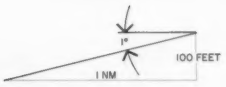


Figure 2

START DESCENT POINT

When using a FLIP instrument approach procedure, published information specifies when to begin descent and dictates the profile. An en route descent (which has no published routing and altitude information) requires computation of a start descent point. In this case, the pilot must lose considerable altitude to arrive over the FAF at an altitude commensurate with a safe final approach.

A method to determine the start descent point, which lends itself quite well to MB-4 Computer "whiz wheel" calculations, involves using the descent gradient. For example, consider an en route descent into Mather AFB for a TACAN final approach to runway 22L, as shown in Fig 3. Prior to any calculations, two questions must be answered:

1. What is the desired descent gradient?
2. How much altitude must be lost?

Usually, a 300 foot per nm descent gradient (3° angle of descent) will provide a smooth, gradual descent. For the Mather example, the answer to question 1 is 300 feet per nm. The answer to question 2 is the difference between the en route altitude and the desired altitude over the FAF. If the approaching aircraft arrives from the east at an altitude of FL 350, and the FAF altitude is 1,600 feet, then the altitude difference is 35,000 feet - 1,600 feet = 33,400 feet. Variations from standard datum plane and mean sea level are negligible.

The start descent point may be calculated with a proportion on the MB-4. If it takes 1 nm to lose 300 feet, how many miles will it take to lose 33,400 feet? Fig 4 illustrates the computer solution. When working with the MB-4, first obtain a mental estimate to find the magnitude of the solution. In Fig 4, the right side of the equation is roughly 100 times larger than the left side, so an estimate of 100 nm confirms that 112 nm is correct. Therefore, using a 3° angle, descent should begin 112 nm

prior to the FAF (Fig 5). Since the FAF is 6 DME from the Mather TACAN, the start descent point is 118 DME. If descent does not begin at 118 DME, a steeper or shallower angle will be necessary. Now, the crew can have an idea of where to begin descent during flight planning, to avoid overshooting the field or prolonged flight at low altitude (with high fuel consumption.)

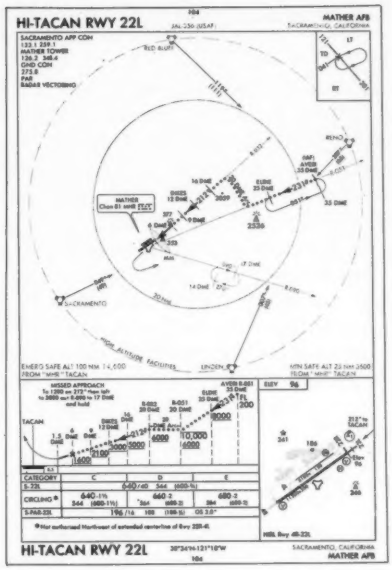


Figure 3

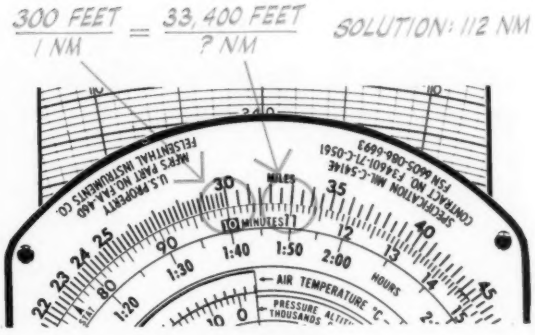


Figure 4

VISUAL DESCENT POINT

Calculations for a visual descent point are very similar to those for the start descent point. A VDP facilitates a more gradual descent on the final course of a nonprecision approach. With visibility permitting, this is also a safety feature which precludes diving at the runway. Many plates depict VDP by a "V" symbol along with the appropriate DME (see Fig 6).

If no VDP depiction is available, as with an Airport Surveillance Radar (ASR) approach, compute the VDP from the method already discussed.

The descent gradient will be a continuation of the gradient employed on the final approach course, approximately 300 ft per nm, and the amount of altitude to be lost is equal to the Height Above Touchdown (HAT).

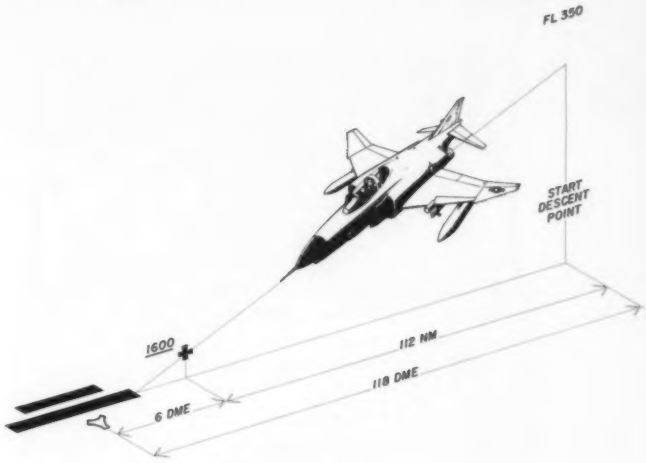


Figure 5

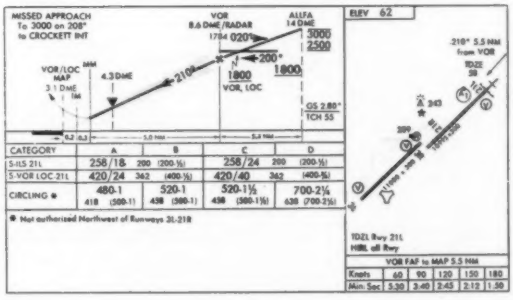


Figure 6

RATE OF DESCENT

A final computation item is the rate of descent or vertical velocity. The rate of descent, expressed in feet per minute, allows the aircraft to maintain a descent gradient by considering the aircraft's groundspeed. Three methods are available to determine the rate of descent.

The first method uses the "Rate of Descent" table in the front of the FLIP high and low altitude approach booklets.

A second method employs the MB-4 computer as a circular slide rule. For example, consider an aircraft on an ILS approach with a glideslope of 3°. The descent gradient is 300 feet per nm. If the groundspeed is 120 knots, the following multiplication yields the rate of descent (notice the unit's cancellation):

$$300\,\frac{FT}{NM} \times 2\,\frac{NM}{min} = 600\,\frac{FT}{min}$$

Figure 7 illustrates the computer multiplication.

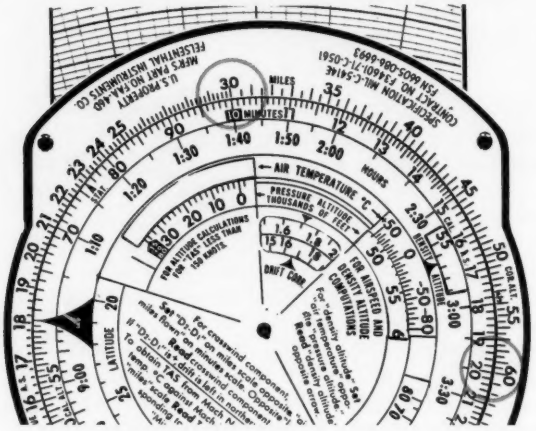


Figure 7

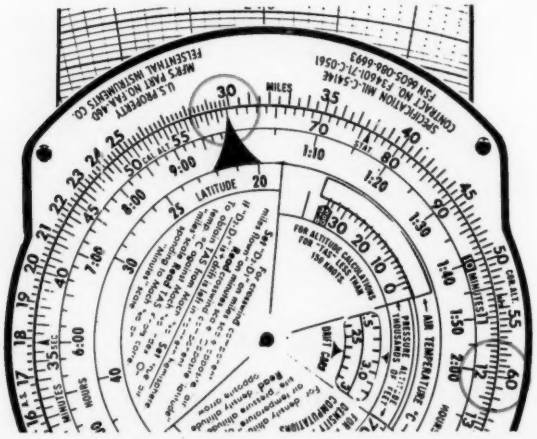


Figure 8

The third method also uses the MB-4 and may be simpler since the groundspeed need not be converted to nm per minute. By placing the descent gradient over the large speed index, the corresponding rate of descent may be read on the outer scale over the groundspeed. Figure 8 shows the solution for this example. Actually, this solution method is a proportion between the rate of descent at 60 knots and the actual groundspeed. The rate of descent at 60 knots (i.e., 1 nm per minute) is numerically the same as the descent gradient. For example, 300 ft/nm at 60 knots corresponds to 300 ft/nm x 1 nm/min = 300 ft/min.

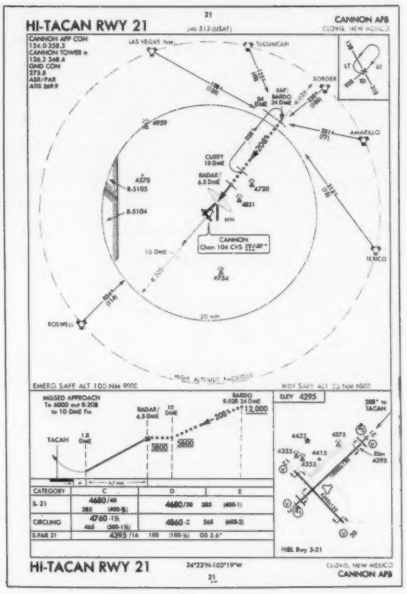
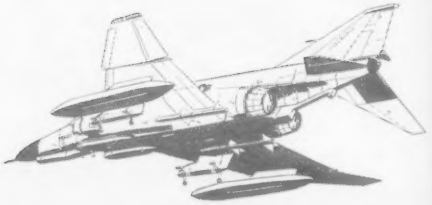


Figure 9



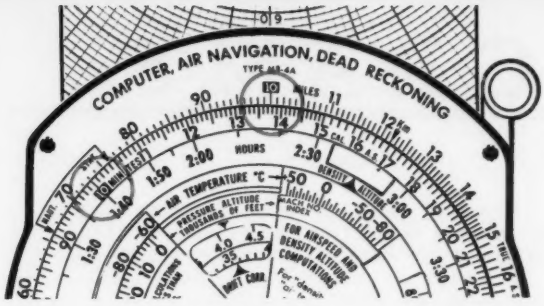


Figure 10

Obviously, the descent gradient is important to these calculations, but sometimes this information is not readily apparent. The initial portion of the Hi-TACAN to runway 21 at Cannon AFB (Fig 9) requires a sufficient rate of descent to reach the mandatory altitude of 5,800 feet at 10 DME. For example, if the aircraft begins the approach at 16,000 feet, then 10,200 feet must be lost in 14 nm to satisfy the 5,800 foot restriction. The descent gradient in this example is 10,200 feet per 14 nm, which yields 730 feet per nm when set up on the MB-4 (Fig 10). If the groundspeed is 240 knots, the rate of descent should be:

$$730 \frac{FT}{NM} \times 4 \frac{NM}{min} = 2920 \frac{FT}{min}$$

Figure 11 a shows the circular slide rule multiplication and Figure 11 b shows the groundspeed proportion method.

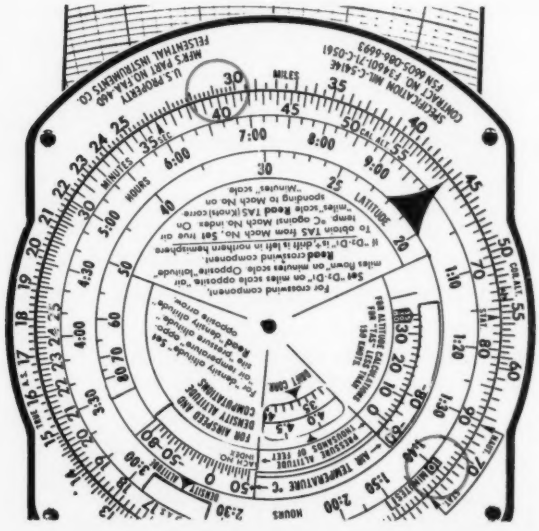


Figure 11a

Figure 11b

An intermediate level-off during an en route descent would pose a similar situation since the original desired gradient would no longer be valid. Moreover, a steeper descent gradient is necessary and this should not be overlooked if an intermediate level-off occurs. Changes in groundspeed will necessitate corresponding changes in vertical velocity to maintain a desired descent. If groundspeed increases, so must the rate of descent. Therefore, periodically monitoring groundspeed can enable the crew to adjust the rate of descent as required.

CONCLUSION

Hopefully, this article will help in improving crew coordination and understanding the descent process. A word of caution—practice on the ground and perform descent calculations for the pilots around required navigator duties to avoid neglecting aircraft position and altitude during descent. Nevertheless, the start descent point, VDP and rate of descent from the nav's MB-4 can be quite useful and appreciated.

A 1975 USAF Academy graduate, Capt Schell received a master's degree in Computer Science from UCLA in 1976. After UNT and CCTS at Castle AFB, he served as a KC-135 navigator at Kadena AB. Capt Schell presently is a KC-135 instructor at Travis AFB.

NAVIGRAMS

Colonel Richard D. Paul recently has assumed command of the 323d Flying Training Wing at Mather AFB. Col Paul, a master navigator, has amassed most of his flying time in MAC and transport aircraft. He was the Commander of the Basic Military Training School at Lackland AFB, TX before coming to Mather.

The 449th Flying Training Squadron (Navigator—Bombardier training) at Mather AFB is currently putting together a permanent display of all B-52 bomber unit emblems. This display will cover both active and inactive squadrons and wings. We would like inputs of unit patches (both wing and squadron) and information about these units from former crew members or squadron members. Patches from inactive wings are needed the most. Contact Capt Lee Johnson, 449th Flying Training Squadron, Mather AFB, CA 95655. AUTOVON 828-2774.

Major Willie C. Register, an F-4 WSO, was recently named as one of America's Ten Outstanding Young Men for 1981 by the United States Jaycees. Major Register is one of only 12 Air Force men who have been so honored and is the first nav to receive the award. Prior to his present assignment in Osan, Korea, Major Register was the Assistant Professor of Aerospace studies at Memphis State University, Tennessee.

The WSO shop at AFMPC has begun publishing a newsletter called GATORGRAM. Each issue includes items about upcoming systems, WSO command positions, career broadening, new trends and a list of requirement eligibility criteria for projected assignments. Response to the first issues has been very good, and all assignments listed were quickly filled with volunteers. Much of the information in GATORGRAM is extremely helpful in filling out your Form 90. For more information, contact the WSO shop at HQ AFMPC/MPCROR2W, Randolph AFB, TX 78150, or call AUTOVON 487-6511.

FREEDOM OF FLIGHT

From the vantage of this endless blue
I look down and I know
never again will I be the same
as those who walk below.

There's a difference now between us
that cannot be explained
but like the altitude I hold
it measures what I've gained.

I've been beyond the ultimate
my supersonic ride
has taken me where they can't go
I've seen the other side.

The gentle tug of mother earth
as I strain to break our ties
the heady joy of weightless flight
as I hurtle through the skies.

No longer bound by left and right
I live in three dimensions
and sail without their limits
soar beyond their comprehensions.

Flight gives me a freedom
that they will never see
that I alone control my life
and guide my destiny.

I pity those of earth-bound realm
awakened by my thunder
who turn their faces skyward, then
are left behind to wonder.

© Captain Bill Sadler

An Interview with Lieutenant General Post

EDITOR'S NOTE: Lieutenant General Gerald J. Post, the Director of the Defense Logistics Agency and the Air Force's highest ranking navigator, visited Mather AFB on 2 April 1981. He addressed a group of students, instructors, and commanders. THE NAVIGATOR magazine interviewed General Post the following day, and his thoughts are of interest to us all.

THE NAVIGATOR: We hear a lot these days about nav commanders of flying units. What do you see in the future of F-4 WSOs' commanding fighter squadrons, C-130 navs commanding airlift squadrons and so forth?

GENERAL POST: Well, the opportunities for navigators to command flying units will continue to increase. General Allen, Chief of Staff, is very serious about expanding command opportunities for navigators. If you don't happen to get command of a flying unit, I wouldn't worry about it too much. There are many other jobs offering just as much experience in commanding. A staff with 8, 10, or 12 people is one example. You are their commander, in effect. My observation has been (in fact, I mentioned this when I sat on the brigadier general board this year) that you can learn as much or more by closely observing good commanders that you work for.

What are some attributes of a good commander?

There are a number of them. I think it's very important to be honest with your people. Commanders should treat people as individuals and recognize that each human being is unique and worth just as much basically as any other human being. If your people sense that you really think they're worth something, you'll be surprised at how hard they will work and what they can produce. Set an example. If you want your people to work hard, you must work hard yourself.

When you were a captain here at Mather in the mid 1950s, what factors enabled you to rise to three-star rank, while most of your contemporaries probably retired 10 or 15 years ago. Can you single out one or two things?

I don't really think so. I enjoyed my three years here at Mather, and served as an instructor for about the first year and a half. When I got the assignment, I believed that the training command would probably have much less hussle and bussle than my previous assignments but I found that was not true. At first I instructed celestial navigation. After about eight months, rather than each instructor specializing in one of their navigation skills, we all became generalists and that changed again before I left. I then became Assistant Operations Officer of one of the training squadrons. I had no idea that I'd ever progress to general officer grade. No idea whatsoever. Luck is certainly a factor, in addition to working hard and taking opportunities as they present themselves, because the number of people fully qualified to do a good job at the next grade is substantially more than the available openings. When I was promoted to brigadier general, I went to the Pentagon for a week of what they call "charm" school. The important people of Washington come in, tell you what's going on, and that sort of thing. All the Chiefs of Staff and the Joint Chiefs, the Secretary of Defense and a few Congressional leaders came over and talked to us. It was a very useful and interesting experience. General John D. Ryan was Chief of Staff of the Air Force when I went to charm school and after talking to us for about 45 minutes, he ended by saying, "If you retire as a lieutenant colonel, you've had a successful Air Force career; if you make it to colonel, you've had a highly successful career; and if you become a brigadier general, you're damn lucky! I have never forgotten that and it's quite accurate. I can recall once when I was asked to take a job at a particular time, it was because the job was just too much for the individual assigned and he'd asked to be relieved. Without this particular job, I don't think I would have ever been promoted to general

officer, so being at the right place at the right time is important and the individual cannot control this factor to a great degree.

What were some of the advantages that your navigator training gave you through your long and varied career?

The ability to think with precision under trying conditions at times, and also the discipline that comes from aircrew experience is invaluable in any endeavor.

Considering upcoming weapons systems and plans, do you think the future of navigation and navigators is bright?

Yes, as far as one can see in the what we intimistically refer to as the foreseeable future, I think the outlook for navigation and navigators is very good.

What are some of the characteristics of a great leader?

Well, integrity is one of the indispensible elements. You may be able to fool your superiors, but you can't fool your subordinates, at least for very long. As a supervisor, you can't have two different sets of rules. Certainly humility plays a big factor, as does having a good memory, and a set of personal priorities.

I'd like your opinion on a hypothetical case. Let's say that a person is doing very well in a job and greatly enjoys the work. He has the opportunity to move up to a highly visible job offering a good chance at below-the-zone promotion, but he detests that particular type of work. Should he accept the job he really doesn't want?

It's an easy one for me to answer. If the individual is serious about going as far as his talents and luck will take him, he should take the job he doesn't like. In fact, it's very good training to do things that you don't like to do. I might suggest, and this happens to all of us on a daily or weekly basis, when you are faced with something that you really don't want to do, the best thing to do is make yourself get at it and get it done. Force yourself to do it.

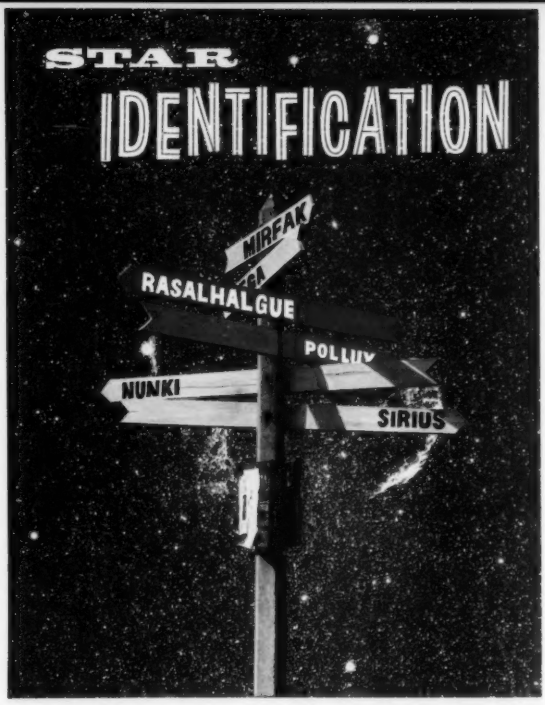
In your 38-year career, you've done a number of different things. In fact reading your interview in a previous issue of the magazine, you've stated that you had three separate and distinct areas of your career, but what do you think have been the outstanding highlights?

I've had highlights as far as the things that I'll remember all my life, in all of those three separate areas. The combat tour in Korea in B-26s was a highly interesting experience. I remember with great fondness my job here as a squadron operations officer. I really learned a great deal and was able to accomplish quite a bit. I remember shortly before I'd taken over we had an IG inspection and the squadron had fallen on it s nose rather badly. I was given the job of fixing that. We had a follow-up inspection in six months, and came out beautifully. It was a matter of getting the people together, identifying the problems, and getting people to understand the problems and how to fix them. I played a large part in that, and I got a great deal of satisfaction. There are similar experiences in each of the things I've done. One thing I'm particularly proud of in my current job is the level of talent, competence and dedication to the right thing. In our business the right thing is supporting the customer, for that's the only reason we're in being. It is very, very high, so high that I have not had to concern myself with keeping up morale, and kicking people's fannies and worrying about people doing things poorly or wrongly. Logistics is so complex there are a lot of opportunities to make mistakes and we certainly make some. But, I've been able to concentrate on economy and efficiency, as has a number of members of my staff. During FY 1980, we saved the American taxpayer 455 million dollars through initiatives within our own agency.

What are your plans for the future?

I'm going to retire at the end of June. I'm going to go to San Antonio and, at least for a while, do my own thing. I'll stay very busy. I've written a book and I have nine more in my head. I have about ten inventions, I guess you'd call them; they're efficiency kinds of things that I've been able to work a little bit on. I'm going to pursue that for a year or so and also do a little unpaid consulting for the Department of Defense. I'm leaving the Air Force with a great feeling of accomplishment and fulfilment and I'm looking forward to retirement with great anticipation.

Thank you very much, sir, and the best of luck to you.



Editor's Note: Various squadrons have requested reprint rights for the following article which appeared in the Summer/Fall 1969 issues of THE NAVIGATOR. Its author was Captain Peter A. Cook of Vance AFB, Oklahoma. So that all of you might benefit from these realistic diagrams, we will print this multi-part article in the next two issues.

In order to take an accurate star shot, it is first necessary to shoot the *correct* star. When using a periscopic sextant, the best way to identify the *correct* star is by recognizing the unique "pattern" formed by the stars in the sextant's field of view. In this regard, the star groups that are usually learned, such as the "Navigator's Triangle", the "Arc of Capella", and the "Baseball Diamond", are too large for easy recognition in the narrow field of vision afforded by most sextants.

The charts presented in this article show the field-of-view patterns for Polaris and all the stars listed in HO 249, Volume I. By using these charts and their accompanying tables, the observer can predict exactly what he will see when looking for a particular star.

Each chart shows the 1st, 2nd, 3rd, and 4th magnitude stars that are visible with a sextant with a 15° field of view when the desired star is in the center. On a clear night many more will be visible; on a hazy or moonlit night only the brightest will show. Lines were included to make the patterns more meaningful. Most of these follow the lines of the better known constellations.

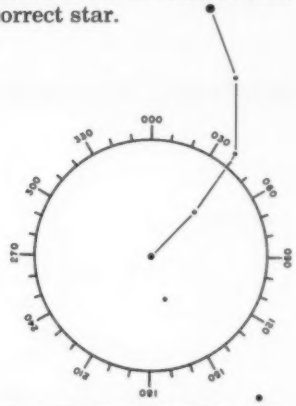
The stars are shown as they would appear from the North Pole. For other latitudes, the accompanying tables of position angles tell how much the charts should be rotated to give the correct presentation for the time of the observation. Dashes indicate that the star is below the horizon at those points.

To use the charts, enter the table with the closest values of latitude and LHA of Aries to find the position angle. Then rotate the chart until this position angle is at the top. The star pattern which results is the one which will appear in the sextant.

As an example, say you want to shoot Polaris. Your latitude is 42° N and your precomp sheet shows the LHA of Aries to be 159. Entering the Polaris table with the nearest values of latitude and LHA (40° N and 150) you find the position angle to be 302. Though interpolation can be used for greater accuracy, it is not usually necessary.

Then take the Polaris chart and turn it until 302 is at the top. In this position, the handle of the "Little Dipper" will stretch out to the right. Now turn the sextant to the precomputed bearing and altitude and look for this pattern. When you see the handle of the dipper leading off to the right, you can easily locate Polaris and will be certain that you are shooting the correct star.

POLARIS



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70N	147	180	213	245	276	305	333	000	027	055	084	115
60N	148	180	212	243	274	303	332	000	028	057	086	117
50N	149	180	211	242	273	302	331	000	029	058	087	118
40N	149	180	211	242	272	302	331	000	029	058	088	118
30N	149	180	211	242	271	300	331	000	029	060	089	118
20N	149	180	211	240	270	300	331	000	029	060	090	120
10N	149	180	211	240	270	300	331	000	029	060	090	120
0	149	180	211	240	270	300	329	000	031	060	090	120
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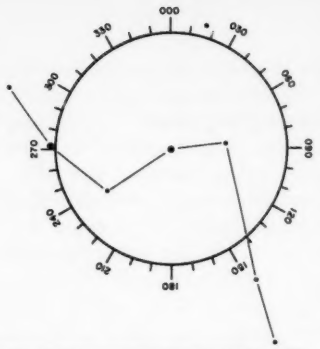
20S	-	-	-	-	-	-	-	-	-	-	-	-
30S	-	-	-	-	-	-	-	-	-	-	-	-
40S	-	-	-	-	-	-	-	-	-	-	-	-
50S	-	-	-	-	-	-	-	-	-	-	-	-
60S	-	-	-	-	-	-	-	-	-	-	-	-
70S	-	-	-	-	-	-	-	-	-	-	-	-
80S	-	-	-	-	-	-	-	-	-	-	-	-

ACAMAR



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50N	-	-	-	-	-	-	-	-	-	-	-	-
40N	032	011	348	327	-	-	-	-	-	-	-	-
30N	037	013	345	321	-	-	-	-	-	-	-	-
20N	044	015	343	320	-	-	-	-	-	-	-	-
10N	050	018	340	309	286	-	-	-	-	-	-	072
0	056	022	336	302	279	-	-	-	-	-	-	079
10S	065	026	330	293	271	-	-	-	-	-	-	087
20S	076	035	321	283	262	245	-	-	-	-	114	096
30S	088	053	302	270	254	238	-	-	-	-	121	105
40S	105	095	265	255	243	230	-	-	-	147	129	114
50S	123	140	223	237	232	222	207	189	170	152	138	127
60S	141	161	201	220	220	212	201	187	172	158	147	140
70S	157	171	190	203	206	203	195	185	175	164	156	154
80S	169	176	185	191	193	192	189	183	176	171	168	167

ACHERNAR

LHA Y / LAT	0	30	60	90	120	150	180	210	240	270	300	330
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40N	-	-	-	-	-	-	-	-	-	-	-	-
30N	-	355	-	-	-	-	-	-	-	-	-	-
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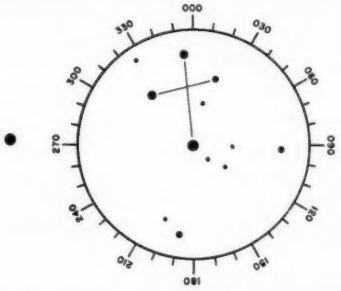
20S	035	351	310	280	255	229	-	-	-	121	096	070
30S	041	349	303	272	249	225	201	-	150	126	103	077
40S	051	346	292	264	242	221	199	175	153	131	110	086
50S	071	334	275	252	234	215	196	176	157	137	118	099
60S	109	234	248	238	224	210	194	177	160	144	130	118
70S	149	189	218	220	213	202	190	178	164	153	144	140
80S	169	183	194	199	197	193	187	179	171	165	162	162

ACRUX



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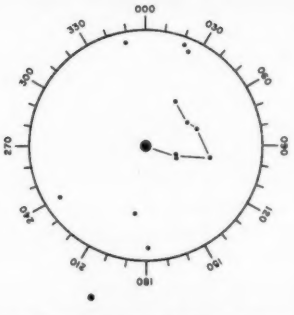
50N	-	-	-	-	-	-	-	-	-	-	-	-
40N	-	-	-	-	-	-	-	-	-	-	-	-
30N	-	-	-	-	-	-	-	-	-	-	-	-
20N	-	-	-	-	-	034	005	337	-	-	-	-
10N	-	-	-	-	064	036	007	335	307	-	-	-
0	-	-	-	-	068	039	007	334	303	276	-	-
10S	-	-	-	100	073	043	008	331	299	271	-	-
20S	-	-	130	105	079	047	008	328	293	266	240	-
30S	185	159	135	110	085	053	010	323	287	260	235	210
40S	185	161	138	116	092	061	012	315	279	254	230	208
50S	184	164	143	123	102	075	019	301	267	245	225	204
60S	183	166	149	132	120	100	059	269	250	234	218	201
70S	182	169	156	144	136	135	166	220	226	219	209	197
80S	182	173	166	160	158	163	177	192	201	201	197	190

ALDEBARAN



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50N	042	033	009	337	322	318	-	-	-	-	-	040
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30N	064	061	026	308	296	298	-	-	-	-	-	059
20N	075	078	061	284	283	287	-	-	-	-	-	-
10N	086	095	127	258	270	277	-	-	-	-	-	-
0	097	109	153	236	258	268	-	-	-	-	-	-
10S	106	122	163	222	247	258	-	-	-	-	-	-
20S	116	133	167	212	237	248	-	-	-	-	-	-
30S	125	142	171	205	227	-	-	-	-	-	-	-
40S	134	149	173	199	218	-	-	-	-	-	-	-
50S	144	156	174	195	211	-	-	-	-	-	-	-
60S	-	162	176	191	203	-	-	-	-	-	-	-
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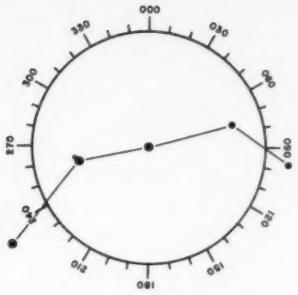
ALIOTH



LHA↑ / LAT→	0	30	60	90	120	150	180	210	240	270	300	330
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30S	-	-	-	-	-	-	168	193	-	-	-	-
40S	-	-	-	-	-	-	-	-	-	-	-	-
50S	-	-	-	-	-	-	-	-	-	-	-	-
60S	-	-	-	-	-	-	-	-	-	-	-	-
70S	-	-	-	-	-	-	-	-	-	-	-	-
80S	-	-	-	-	-	-	-	-	-	-	-	-

ALKAID

LHA↑ / LAT→	0	30	60	90	120	150	180	210	240	270	300	330
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60N	346	002	017	032	044	050	046	348	310	311	319	332
50N	343	003	022	039	054	068	080	271	283	296	309	325
40N	340	003	025	045	064	082	109	197	260	283	300	319
30N	-	-	-	052	073	094	125	190	244	272	293	314
20N	-	-	-	057	080	103	136	187	234	263	286	-
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10S	-	-	-	-	-	123	152	185	217	244	-	-
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40S	-	-	-	-	-	-	-	-	-	-	-	-
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60S	-	-	-	-	-	-	-	-	-	-	-	-
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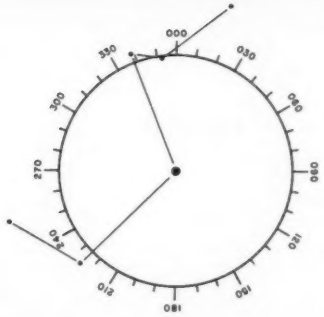
ALPHARD



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20S	-	-	109	109	122	212	248	252	-	-	-	-
30S	-	-	119	121	140	198	233	240	-	-	-	-
40S	-	-	129	134	152	191	221	230	-	-	-	-
50S	-	-	139	144	161	188	210	220	219	-	-	-
60S	-	-	149	154	167	186	201	209	209	-	-	-
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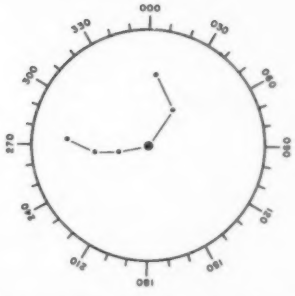
ALPHECCA



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60S	-	-	-	-	-	-	-	168	183	-	-	-
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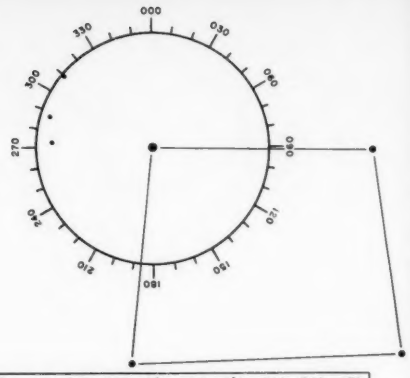
ALPHERATZ



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40N	007	305	300	306	-	-	-	-	-	053	059	057
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60S	179	-	-	-	-	-	-	-	-	-	-	-
70S	-	-	-	-	-	-	-	-	-	-	-	-
80S	-	-	-	-	-	-	-	-	-	-	-	-

ALTAIR

LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
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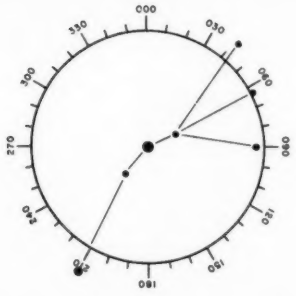
ANTARES



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50S	216	-	-	-	149	138	134	141	171	211	225	224
60S	207	197	-	-	156	148	147	154	175	199	212	213
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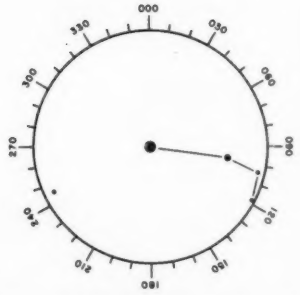
ARCTURUS



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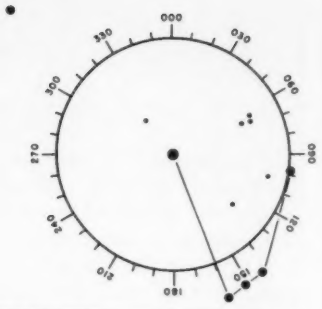

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50S	-	146	160	182	202	215	-	-	-	-	-	-
60S	-	154	166	181	196	206	-	-	-	-	-	-
70S	-	163	170	180	190	197	-	-	-	-	-	-
80S	-	-	176	180	185	-	-	-	-	-	-	-

CANOPUS

LHAT / LAT	0	30	60	90	120	150	180	210	240	270	300	330
80N	-	-	-	-	-	-	-	-	-	-	-	-
70N	-	-	-	-	-	-	-	-	-	-	-	-
60N	-	-	-	-	-	-	-	-	-	-	-	-
50N	-	-	-	-	-	-	-	-	-	-	-	-
40N	-	-	-	-	-	-	-	-	-	-	-	-
30N	-	-	031	005	339	-	-	-	-	-	-	-
20N	-	-	034	006	337	310	-	-	-	-	-	-
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60S	139	129	126	159	230	233	225	213	199	184	168	152
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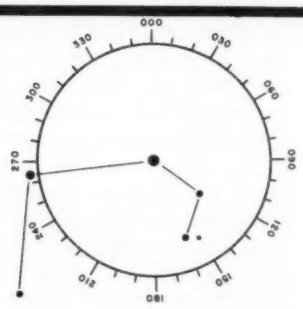
CAPELLA



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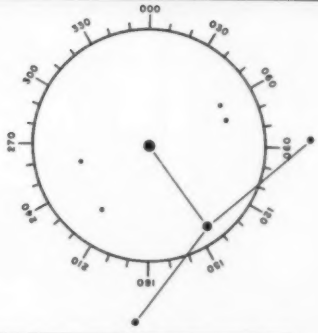
20S	-	134	162	193	220	-	-	-	-	-	-	-
30S	-	140	164	191	216	-	-	-	-	-	-	-
40S	-	-	166	189	-	-	-	-	-	-	-	-
50S	-	-	-	-	-	-	-	-	-	-	-	-
60S	-	-	-	-	-	-	-	-	-	-	-	-
70S	-	-	-	-	-	-	-	-	-	-	-	-
80S	-	-	-	-	-	-	-	-	-	-	-	-

DENEB



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70N	332	331	336	345	356	007	018	026	030	025	009	345
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20N	255	277	298	-	-	-	-	069	090	114	159	219
10N	246	269	-	-	-	-	-	076	098	124	164	212
0	239	263	-	-	-	-	-	-	104	130	166	207
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20S	227	-	-	-	-	-	-	-	-	141	170	201
30S	222	-	-	-	-	-	-	-	-	146	171	198
40S	-	-	-	-	-	-	-	-	-	-	173	195
50S	-	-	-	-	-	-	-	-	-	-	-	-
60S	-	-	-	-	-	-	-	-	-	-	-	-
70S	-	-	-	-	-	-	-	-	-	-	-	-
80S	-	-	-	-	-	-	-	-	-	-	-	-

The 1980 USAF Navigator Symposium

Captain Steven E. FLEMING
Captain Truman N. TAUER
USAFA/CWIN
US Air Force Academy, CO

Have you ever wondered what command opportunities exist for a navigator? Are you concerned about performance ratings, assignments, promotions, and school selections in the navigator world? Do you wonder if there will be a viable navigator career field in the Air Force of the 1980s and 1990s? These topics were some of the issues discussed at the Third Annual USAF Navigator Symposium held at the Air Force Academy from 8-12 December 1980.

The theme for the 1980 USAF Navigator Symposium was "Navigator Professional Development." In harmony with this theme, six navigator general officers provided keynote addresses throughout the week. Their addresses highlighted the many opportunities now available to the navigator who is truly concerned with professional development. During the five days of the symposium, 111 officers, representing the operational commands, received special briefings by the MAJCOM staff navigators on nav manning and utilization. These briefings provided baseline information for use in discussions during working group sessions.

The Symposium was sponsored by the USAF Academy. Lt Gen Kenneth L. Tallman, Academy Superintendent, delivered the opening remarks. After the opening address, symposium attendees received a number of informative briefings. AFMPC staff navigators briefed on "Navigator Utilization 1981 through 1986," "Navigators in Command," "USAF Retention Group Update," and "Navigator Promotions."

The briefing on Navigator Utilization presented detailed information on navigator requirements versus inventory in the next few years. According to AFMPC projections, a navigator shortfall will continue in the near term, should bottom out in 1983, and should be corrected in 1985. Air Force commitment to maintain staff and supplement opportunities for navigators in spite of rated shortages is reflected in the following figures: staff manning at 85%, rated supplement manning at 78%, and ATC manning at 96%. Solutions for the navigator shortfalls are to add more navigators to the force and reduce the number leaving the service. (Efforts to reduce the number of losses were presented in a separate briefing.)

The briefing on "Navigators in Command," a topic which AFMPC indicates is of special interest to the Air Force Chief of Staff, was very well received. Statistics show a marked improvement in the number of navigator commanders in the past three years. Problems impacting navigator command opportunity related to attitudes in some of the MAJCOMs and traditional navigator career patterns. The briefing was clear that key positions are available to navigators who perform. The major factors in command selection will be individual performance, rated experience, and willingness to compete.

NAVIGATORS IN COMMAND POSITIONS
(Flying Organizations)

	ATC	TAC	USAFE	PACAF	AAC	MAC	SAC	AFSC
WG/CC	0	0	0	0	0	0	0	0
WG/CV	1	0	1	0	0	0	0	0
WG/DO	1	0	0	0	0	0	0	0
WG/ADO	0	0	1	1	0	0	0	0
SQ/CC	5	7	4	0	0	1	1	0
SQ/OPS	5	3	3	2	0	4	4	0
FLT COMDR	26	28	24	8	4	NA	22	4

Data supplied by AFMPC as of 31 Dec 80

The retention briefing updated the USAF Retention Group statistics and assessed how we are doing in the retention area. The projected shortfall for the next two years is 935 navigators. The greatest loss rate occurs in the 6-11 year group. While the current crew force has a substantial number of officers assigned with 10-15 years of service, by the end of 1985 the bulk of aircrew positions should be filled by officers with 1-6 years of service. The assessment of the USAF Retention Group is that the climate is starting to improve but caution must be exercised as retention rates are still unacceptable.

The final AFMPC briefing addressed "Navigator Promotions" and probable causes of lower selection rates for navigators. One factor is the disproportionately small number of top block ratings stemming from less responsible jobs, junior or peer rating officials, limited career development opportunities, and rated supplement drawdown. There are no easy answers to these problems. Improving career development opportunities will improve navigator records and make navigators more competitive for promotion.

Following AFMPC update briefings, presentations were made by MAJCOM representatives from SAC, MAC, TAC, the National Guard Bureau, the Air Force Reserves, and Air Force Systems Command. Special briefings were given on the USAF Navigator Procurement Program and results of the ATC Procurement Workshop, the history of aeronautical ratings and proposed "Command Navigator" rating, navigator selection research and proposed changes to the AFOQT, opportunities for navigators in the SR-71 and Academy T-43 flying programs.

The final phase of the symposium was devoted to working groups established to identify and discuss issues of general concern. Following are some of the recommendations made by the working groups during the symposium outbriefs.

COMMAND OPPORTUNITY

- Increase navigator involvement in overall mission accomplishment.
- Expand use of navigators as "crew commanders."
- Encourage individual navigator pursuit of responsibility.
- Expand the supervisory role for navigators, especially during the early parts of their careers.

ASSIGNMENTS

- Increase commander flexibility to assign the best qualified officers to their staffs.
- Increase individual rated officer control in the assignment process.
- Continue to provide rated supplement opportunities for navigators.
- Expand staff experience for younger navigators.

PROMOTIONS/PME

- Include promotions briefer on MPC team visits.
- Eliminate official photographs for company grade officers.
- Emphasize critical Air Force skills (pilot, navigator, engineer, etc.) under DOPMA continuation programs.

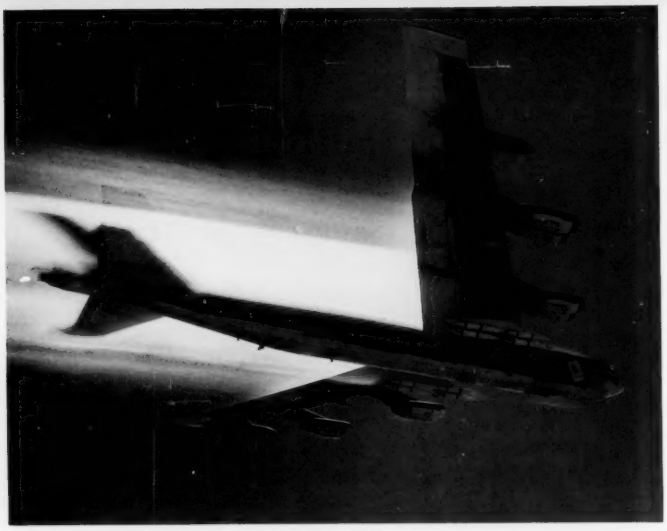
Minutes of the 1980 USAF Navigator Symposium are being distributed to the field. These include briefing slides from many presenters and contain over 300 pages of material relating to Navigator Professional Development. Questions concerning this event can be addressed to Lt Col Bill Butler at the Academy, AUTOVON 259-3790/3582.

Capt Fleming entered the Air Force in 1972 via ROTC. After UNT he was assigned to AC-130s in Thailand, followed by a tour at Little Rock AFB in C-130s. He served as an instructor and Wing Scheduling Officer at Little Rock. Capt Fleming is presently a Course Director in the Aviation Science Division at the Air Force Academy.

A graduate of St Cloud State University, Capt Tauer entered the Air Force in 1970. He completed UNT and was assigned to the KC-135 at Wurtsmith AFB. He served a tour in SEA in the F-4, followed by an assignment to Mather in the 904 ARS. Capt Tauer now serves as Operations Plans Officer and Course Director in the Aviation Science Division at the Academy.

The Mighty B-52

Lieutenant Colonel William W. MILLER
449 FTS
Mather AFB, CA



In 1946, competition for an intercontinental bomber was conducted by the Air Force, and won by the Boeing Model 462. This was a scaled-up B-50 with six turbo-prop engines, but the craft could not meet the government range specification of 5,000 miles. The Wright Company worked to develop an improved engine and Boeing was given a paid study contract in April 1946 with the designation XB-52.

The Boeing Company had, since 1943, been working towards an all-jet bomber. Testing conducted in the summer of 1944 showed that straight-wing aircraft probably could not make full use of the jet propulsion potential. Because of these tests and new designs, Boeing was awarded a study contract for an aircraft called the XB-47.

After Germany was defeated in 1945, three Boeing aeronautical engineers participated in a German weapon development study. These men brought back research data on swept wing performance at or above Mach 1. Boeing then tested numerous wing designs, various locations for engines, and types of landing gear. Their extensive research and development resulted in the XB-47 which rolled out 12 Sep 1947.

The B-47, which began demonstrating how well a pure jet bomber could function, was considered a medium weight plane with a restricted range. The USAF experts at Wright-Patterson AFB drew up new requirements for a jet strategic bomber in the summer of 1948. One Thursday in October, Boeing received the requirements and their design team began working on a proposal. They designed an 8-engine bomber, using the new Pratt and Whitney J-57 engine. On Saturday, the team went to a local hobby shop and bought balsa wood and, by Sunday evening, the first B-52 model was ready, complete with USAF markings. The astonished Air Force project officer received this model on Monday, along with a detailed written proposal and supporting graphs. Preparations to build two prototypes, XB-52 and YB-52, began early in 1949. The YB-52 was the first to fly on 15 April 1952.

The Stratofortress, as the B-52 was called, looked like an enlarged B-47, but there were numerous differences in this giant new bomber. After successful testing of the first two experimental aircraft, the initial production model, B-52A, first flew on 5 August 1954. The cockpit was changed from the tandem type of the X and Y B-52s to side-by-side seating. The B-52 entered operational service in June 1955, with the 93d Bomb Wing at Castle AFB, California. These "B" models were equipped with the M-2 bombing radar and navigation system.

Numerous improvements followed. The B-52C was equipped with 2,500 gallon underwing tanks and strengthened structurally. It contained the ASQ-48 bombing and navigation system. The D model was the first version of the B-52 built at the Boeing, Wichita plant. In 1956 and 1957, 175 B-52Ds were delivered to the Air Force.

The B-52G, which first appeared in July 1958, introduced a whole series of improvements. Included were complete structural redesigns, integral wing tanks, relocation of the gunner to the forward crew compartment, elimination of ailerons, fully powered elevator and rudder, provisions for launching Quail decoy missiles, and provision for launching the Hound Dog missile. The 193 B-52Gs built made this the most widely produced model.

The G model was supposed to be the last B-52, but the development of an air-launched ballistic missile, the Skybolt, led to the B-52H. The Skybolt program was cancelled, but 102 H models were built.

The B-52H introduced four main changes. The first was the new TF33 turbofans which allowed faster takeoff, steeper climb, and much greater range. These engines eliminated the need for the heavy water-injection system. The second was an improved fire control system, ASG-21, which featured a 20 mm Gatling gun, plus a dual system for radar target tracking. The H model also had a new heading system, the AJN-8, which provided improved heading and stabilized inputs to the bomb/nav system. The fourth change, and probably the most significant, was that the H model was designed explicitly to fly in the low altitude environment. This required more than 120 structural modifications, a terrain-avoidance radar, and improved ECM equipment. In all, 744 B-52s were built, and the C through G models were modified to fly low level at considerable but necessary costs.

The B-52G and H models will soon receive a new offensive avionics system. The Air Launch Cruise Missile (ALCM) will also be added, beginning with the 416th Bomb Wing, Griffiss AFB, New York, in the summer of 1981. The D models will receive a new avionics system, called the Digital Bomb Nav System, which began flight tests at Carswell AFB, Texas, in the summer of 1980.

The B-52 is a navigators' airplane and mission accomplishment depends on the navs' abilities. There are three rated navigators on a B-52 crew: the radar navigator (bombardier), the navigator, and the electronic warfare officer.

The radar navigator and navigator work together to insure successful mission completion. They are provided with a bombing and navigation system (BNS) for navigation, solution of the bombing problem, and rendezvous with tankers. The BNS is also the source for certain data required by the SRAM. The BNS continuously determines the aircraft position, supplies the auto-pilot with a heading error correction for navigation, and computes the time to the bomb release point. It is the radar navigator's job to continuously update this equipment to provide the precise outputs described above. Related subsystems include an automatic astrocompass, Doppler radar, and a true heading system. B-52G and H aircraft also have the SRAM conversion unit. The SRAM system interfaces with the BNS system for accurate programming and missiles launch and can be used to assist with aircraft navigation and bombing.

The nav paces the crew throughout the mission, calling out important points, such as the positive control turn around point, and running checklists needed to complete the sortie. He is responsible for directing the aircraft along the desired course, programming and launching SRAMs. The radar navigator assists the navigator with enroute navigation, makes the tanker rendezvous for in-flight refueling, and delivers the gravity weapons.

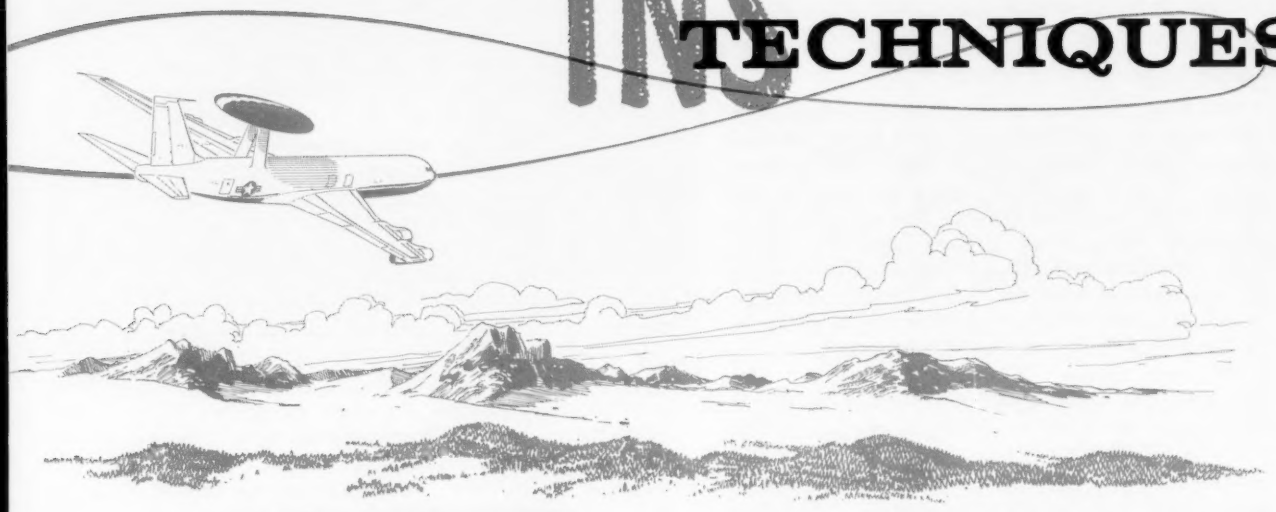
The primary responsibility of the electronic warfare officer is defending the aircraft against ground-based or airborne electronics defenses. Secondary responsibilities include obtaining celestial observations for the navigator and monitoring liaison radio communications. Never underestimate the importance of electronics in modern warfare. Without electronic countermeasures (ECM), enemy defensive systems could inflict heavy losses on an attacking force.

The B-52 EW's job is to deny the enemy use of his defense system by degrading, saturating, or destroying it or its key components. The EW also employs flares and chaff to counter the enemy. To accomplish this task, receivers are carried to detect threats and a variety of jammers are available which operate on broad frequency bands.

Modifications are planned, as explained earlier, to all models of the active B-52s as roles are continually expanded. Two wings of B-52H models are being given the "Big Belly" modifications to increase their conventional carrying ability. B-52s are flying sea surveillance missions, training for contingency operations anywhere in the world, and daily standing nuclear alert. But as great as it is, the B-52 is still a machine, and machines are nothing without the talented, dedicated men who crew them. Navigators comprise the heart and soul of the B-52 mission and will keep it a viable weapon system until replaced by a new manned penetrator.

Lt Col Miller graduated from Grove City College in 1964 with an ROTC commission. After UNT in 1968, he served as a B-52 instructor navigator and instructor radar navigator, followed by 140 B-52 missions in Vietnam. In 1975, he obtained a master's degree from Northern Michigan University. Assigned to Mather in 1977, Lt Col Miller served in various positions before becoming Commander, 449 FTS.

INS TECHNIQUES



Captain Lenard M. KAUFMAN
964 AWACS/DOTL
Tinker AFB, OK

As technology progresses, one day almost all Air Force aircraft will carry a very reliable, accurate inertial navigation system (INS). For many of us, that day is already here. With the INS equipment now available, we can easily do things that once would have taken a great deal of effort.

This article will pass along some INS techniques that can make life a little easier.

DESCRIPTION

The Carousel IV (AN/ASN 119) INS is similar to those now carried on C-141s, C/KC-135s, and E-3As. We will discuss the control/display unit (CDU) panel (see Fig 1). The display windows show the lat/long of the aircraft's present position or waypoints. A number of displays are available through the selector knob. The auto/manual switch, placed in auto, allows the INS to automatically sequence to the next waypoint when the "TO" window waypoint has been reached. When the auto/manual switch is in the manual position, automatic sequencing does not occur. When the waypoint in the "TO" window is reached, the ALERT light flashes until new waypoints are manually inserted. With the autopilot coupled to the INS, the aircraft will maintain the previous ground track after waypoint passage, until new waypoint insertion.

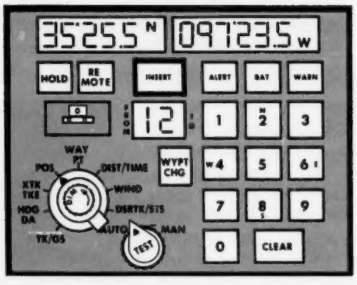


Figure 1

RACETRACK/HOLDING PATTERN TECHNIQUES

Let's say that you must maintain a racetrack pattern between two points (Fig 2). After you pass waypoint #4, place the auto/manual switch in manual, and uncouple the INS, maintaining the heading. When the aircraft reaches waypoint #5 the alert light will start flashing. Have the pilot manually make the turn, estimating a bank angle that will give you the desired radius of turn. By monitoring XTK/TKE, you can tell how far you are from the line. After roll-out, keep the switch in manual, hit waypoint change 5 to 4, and insert. The aircraft (still uncoupled from the INS) should be flown parallel to the 5 to 4 line the desired number of miles to left or right. When the point perpendicular to waypoint #4 is reached, the alert light will again flash. The pilot should again manually turn the aircraft and repeat the whole process.

Figure 2

Another variation of this technique is shown in Fig 3. Instead of following on one side, the waypoints are inside the racetrack. Have the pilot uncouple the INS and manually fly the aircraft the required number of miles left or right of the desired track between waypoints 4 & 5. Again the auto/manual switch is placed in manual. As in the other technique, the ALERT light will flash. At that time, turn the aircraft, roll out when the aircraft achieves the desired crosstrack, manually reverse the waypoints and continue the process. Never fly down the track between WP 4 & 5 using this second technique.

Figure 3

FIGURE 8 PATTERN

The figure eight is a variation of the racetrack pattern, flown in a similar manner. In the first figure eight technique (see Fig 4), the two waypoints (4 & 5) fall on the same straight leg of the figure eight. The INS should be disengaged, and the auto/manual switch should be placed in manual. Upon reaching the waypoint, the alert caution light will flash. At that time, have the pilot make a turn. Manually reverse the waypoints in the from/to windows (5 & 4) and roll out when you obtain the desired lobe diameter/cross track distance. When approximately 1/4 to 1/3 of the distance between the two waypoints has elapsed, change your heading by approximately 45°, and cross the desired track between the two waypoints. Maintain that heading until you get the approximate number of miles cross-track for the second lobe. Roll out if the ALERT caution light is not flashing, and maintain a heading parallel to the line between the two waypoints. When the light starts to flash, reverse the direction of your first turn, and duplicate the desired lobe diameter. To complete the figure eight, continue these procedures.

Figure 4

An alternate figure eight pattern (Fig 5) would be achieved in much the same manner as the first figure eight technique. The wrinkle is that the two waypoints fall in the center of the lobes, not on a leg.

Figure 5

When you reach waypoint #4, obtain the correct radius of turn, and cross track from the desired track between waypoints 4 & 5. When approximately 1/4 to 1/3 of the distance has elapsed, turn 45° from heading to cross the line between the two waypoints. If you have not passed the next waypoint (ALERT light will flash when switch is in manual), roll out to a course parallel to the desired heading. When the alert light flashes, turn in the direction of the waypoint and maintain the proposed radius of turn. Reverse the waypoints in the "FROM/TO" window and repeat the procedure. These techniques are not exact in their application. Trial and error is necessary due to wind and other considerations. If you do have a requirement in future missions for these or similar type holding patterns, a little planning and thoughtful use of an INS can make life a bit easier.

the old and delicate perisopic sextant

Lieutenant Colonel William P. WILSON
00-ALC/MAC
Hill AFB, UT

It's 2227 Zulu, your heading is 311 degrees, and your last good position was 22-18 South and 96-52 East. That, however, was more than an hour ago. During the weather briefing at Perth, the forecaster warned of the southeast trade winds that blow strongly toward the equator during this time of year. That may help to explain why the red bar has been jumping across the Doppler readout for the past 40 minutes. Normally, the inertial system would provide position information, but it has been inoperative since you left Guam two days ago. With basic dead reckoning techniques, you know you're about midway between Perth and your destination, Diego Garcia. You're too far south, however, to pick up any radio bearings from the Cocos Islands.

Sound like quite a predicament? Well, not really—for the experienced navigator knows what to do. He or she turns to the instrument that is probably the oldest and most delicate in the aircraft. That's right—the periscopic sextant. Since the sky is clear, the navigator is only a precomp away from a three-star celestial position.

But will the sextant work properly and can you rely on the height readings? That's what this article is about—the sextant—and the people who are dedicated to making it reliable for the navigator to use.

Approximately 35 highly professional instrument repair technicians at Hill AFB, Utah, keep the old sextants in operational condition. (The newest sextant we've seen was built in 1952). The men and women who work on the thousands of sextants sent to the Air Logistics Center each year are divided into two repair teams, supervised by Verle Layton and Roe Taylor. Each team has technicians who specialize in the repair of various sextant components.

These technicians have some very good suggestions for the navigator on the care and handling of the sextant in an effort to increase the operational life of this old instrument between depot overhauls. Today, the average operational time between overhauls is only about 38 minutes. Considering the normal two-minute celestial observation, this doesn't translate to much time between sextant malfunctions. Their desire is to create a working partnership with the navigator in an attempt to prolong the usefulness and reliability of the sextant.

John Pengelly, one of the incoming inspectors states, "Communication is an important key to the delicate handling needed to prolong the operational life of the outmoded sextant. We need to communicate to both the navigator and the field maintenance technician just how sensitive this old sextant really is, and the difficult problems we are having trying to keep it in working condition."

Leah Covington, who also diagnoses the malfunctions of incoming sextants, stresses the importance of communication to field maintenance personnel about proper sextant disassembly and repair in the field. For example, she points out that, "Removal of the left side cover by field level maintenance is authorized, but the removal of the right cover directly affects the collimation accuracy of the sextant."

One of the more vulnerable items in the sextant is the pellicle, which is about the size of a fingerprint, thin as plastic wrap, and very brittle. The pellicle reflects the bubble into the field of vision, and it is easily broken with a sudden jolt or blow to the sextant. Leah says, "More than half the sextants sent in for repair require a new pellicle." So, the next time you slam the sextant up into the mount and can't get a bubble to show in the field of vision, you could have ruptured the pellicle.

The sextant clock has two jewels with pivots that are also ultrasensitive to rough handling and bumps. Orion Mack must adjust every clock jewel assembly to 0.001 inch end play in the hair spring and balance works. He points out, "Rough handling of the sextant causes the hair spring collar to loosen so that the clock becomes sluggish. When this happens, the clock must be sent to the depot for overhaul since it cannot be fixed in the field."

The temperamental part of the sextant is the averager. Mae Koer and Roy Ziegenhirt have accumulated more than 15 years experience adjusting sextant averagers so they work within tolerance. The averager contains more than 300 interlocking parts, separately manufactured over 30 years ago. Trying to make them all fit and operate today is akin to solving a Chinese puzzle.

Roy mentions that, "One of the most frustrating aspects about the averager is that all 300-plus parts must be carefully cleaned, repaired, and reassembled before it can be checked for slippage or other malfunctions." It is strictly a trial-and-error situation. Sometimes the averager can be overhauled in 3-4 hours, but usually it's longer and sometimes takes 2-3 days to rebuild it to acceptable working condition. He draws specific attention to the use of the rewind lever. "The lever rewind stop pin is smaller than a pencil lead, and flipping the rewind lever can break or bend the pin allowing averager slippage."

Mae outlined operating precautions that some navigators may not be fully aware of such as the proper use of the altitude control knob. The tech order specifies rapid, smooth operation of the altitude control knob is acceptable. She states, "Jerky or excessive whip rotation of the altitude control knob between star observations will definitely induce averager slippage and an artificial displacement in the altitude indices. Another design deficiency in the averager which can create up to five degrees of altitude error is the small dialing gear assembly. By applying excessive downward pressure on the rewind lever, or by flipping it, the small gear pin can become bent or broken which causes the averager indices to stray from the lubber line."

Each bubble chamber is disassembled, cleaned, and reassembled by Elaine Hammer. The highly delicate chamber contains many parts and several lenses that require skillful care and expertise. She points out, "The bubble assembly can be interchanged by field level maintenance, and many are returned directly to the depot for renovation. Many bubble chambers arrive weekly with badly scratched lenses and the majority of the fluid has been allowed to escape."

The next step involves Richard Watson who flushes and fills the bubble chamber with silicone dampening fluid. He states, "The fluid costs more than $100 per gallon and is tricky to work with. In addition to proper sextant storage, the navigator should guard against two things to prevent a leaking bubble chamber. Avoid inward pressure on the bubble size adjustment knob and rotating the knob rapidly." Both of these actions can induce excessive air into the chamber. He further mentions, "Bubble chambers taken apart in the field frequently have a great deal of contamination in the bellows and compensator which is almost impossible to remove."

With the sextant reassembled, Mike Van Limburg performs the precollimation checks and the firm alignment of the crosshairs. For this alignment, he uses a precision 4-point collimation stand for sextants that requires calibration every week. Mike advises, "During some field trips, we found collimation stands that had not been calibrated for over a year. Without proper calibration, the stand will adversely affect the accuracy of the sextant."

As you can understand, the old sextant concerns both the navigator and the repair technicians here at Hill. With proper care and use, as well as continued maintenance, these instruments should be useful for many years. The next time you do a sun shot or take a three-star fix, remember to treat the sextant—a delicate, but vital navigation tool—with special care.

The Dream Machine — A-6 Intruder

Lieutenant (JG) Paul K. LYNCH
VA-75
NAS Oceana, VA

Another night launch—200 overcast, 3,000 broken, 25,000 scattered, ½ mile visibility in rain and thunderstorms, 12 foot seas.

The general briefing is not particularly involved. Everything is pretty much standard. We carefully pick our route of flight to the target, covering SAM and AAA sites, and how we will return. The target area will be dark and it will have to be a "system delivery." Twenty-eight MK82 500-pound bombs should leave a few holes in the ground.

Tonight our single A-6 Intruder will strike a synthetic fuel plant 150 miles inland. Fortunately, the weather will be better in the mountains after we get "feet dry." Our briefing stresses "crew concept." My pilot and I have been flying together for three months and know how each other thinks. The side-by-side seating arrangement of the A-6 is excellent for the plane's mission. The leg through the mountains will keep us from being detected by enemy radar, but it could also kill us. Total confidence in each other's professional capabilities is a must. The deck is pitching 14 feet and it is a thoroughly black night. This cat shot will definitely be an eye opener, being shot from a pitching, rolling deck into a black hole with no horizon. Where is that 12,000 foot runway? 10,000 foot runway? 8,000 foot runway? ANY RUNWAY? Why can't our "compatriots in blue" take this mission? Who cares if the closest land base is 2,000 miles away from the target?

Preflight is thorough and smooth despite the cold, the wet and the darkness. Each crew member is responsible for a complete preflight of the aircraft and ordnance. You can't abort a takeoff on a 300-foot catapult stroke. Once that cat fires, you have "bought what you have got," and you're flying (or swimming!).

We get a good alignment on the inertial navigation system (INS). The UHF hookup to the ship's INS speeds up the alignment. Computer, radar, FLIR (Forward Looking Infrared Receiver), and laser BIT checks are all "go." Fortunately, all our equipment is cooperating.

The A-6 Intruder uses the AN/ASN-92 Carrier Inertial Navigation System (CAINS). (The

CAINS system is also found in the E-2 Hawkeye, S-3 Viking, and F-14 Tomcat.) It provides the primary attitude reference as well as velocities in three axes which the computer massages into ground speed, wind velocity and direction, and altitude. Alignment procedures are simple, requiring only present position inputs. On board ship, the data may be entered via a UHF link to the ship's INS, a cable link, or manually. An alignment is achieved automatically in a few minutes ashore or aboard ship.

Time to enter all the data: turnpoints, checkpoints, offset aim points (OAPs), and target data. The AN/ASQ-155 computer can hold several targets each, with an OAP capability, plus waypoints and a navigation checkpoint function. The computer is the key to the A-6 Intruder. It holds all the data, provides steering information, generates terrain avoidance information, computes ballistic solutions and controls the radar cursors. Nearly 20 years fleet experience has resulted in numerous backup and degraded modes in case of failure or flak damage.

The A-6 computer is operated and controlled by the Bombardier/Navigator (B/N). It is the hub of all navigation and attack functions and allows the A-6 to be an all-weather attack aircraft. In conjunction with the AN/APQ 156 radar, the computer provides altitude and terrain clearance/avoidance information to the pilot via the TV screen vertical display indicator (VDI). All navigational steering is generated by the computer via data input and radar cursor placement by the B/N.

The "coast-in point" is 50 miles away. Time to get down "in the weeds." Our crew concept now will be tested to the utmost. Our internal distrust of machines has the B/N backing up the computer manually at all times so that the pilot doesn't steer into a ridge line. The old method of terrain avoidance is still used as a back up, i.e., if the shadow on the radar screen is not filling in behind the mountain, "You ain't goin' to make it, son!"

Turnpoint coming up. The sharp bend in the river will be a good place to update our position in the computer. Good chance to check out the FLIR and laser also. The target area is no place to see if they are working properly. Ten miles out and the FLIR's TV-like presentation enables the tree line and river bank to be seen clearly.

This newest addition to the A-6 is called TRAM, Target Recognition Attack Multisensor. TRAM gives the A-6 forward-looking infrared viewing, laser ranging, and laser designation capabilities. The TRAM provision is achieved by mounting a stowable turret just under the nose of the A-6. This so-called "wart" contains the FLIR, laser ranger and designator. The laser ranger allows precise calculation of the distance between a target and the attack aircraft and then designates the target, if a laser guided smart weapon is to be delivered. The FLIR permits more accurate cursor placement, especially on a poor radar or non-radar significant target. Thus TRAM gives the Intruder unprecedented bombing accuracy. The laser receiver can be used with an external laser designator. Therefore, the B/N can destroy a target illuminated by another aircraft, forward air controller, or "ground pounder." An additional feature of TRAM is bomb damage assessment (BDA). This is accomplished by using the onboard video tape recorder to record the FLIR imagery when exiting the target area. The B/N can play back the tape for a quick BDA and then subsequently debrief the intelligence types.

Two minutes to the IP. Still no ECM lock-on indications. The combination of our terrain masking, a squadron mate's preemptive antiradiation missiles, and jamming by EA-6B Prowlers has kept our presence undetected. One more check of the ACU (armament control unit): stations selected, straight path attack, bomb train, mechanical fusing set, electrical fusing set, bomb interval set, quantity set, timer function set, master arm on. We are ready, I think; all that switchology!

The B/N doesn't learn his switchology overnight. The training program for the A-6 begins after the naval flight officer (NFO) receives his wings. Approximately one year of training is required for the prospective NFO to "be winged." Training includes basic flight familiarization, navigation, communication, and ACM. Many hours in the classroom, simulators, and in flight are spent learning to navigate

visually and by radar. Finally, the NFO reports to a fleet replacement squadron (FRS) to be trained as a B/N. The FRS is commonly termed the "RAG", an old acronym for Replacement Air Group. The A-6 RAG averages eight months, with many hours spent learning the system. The complexities of the radar, computer, armament control unit, FLIR, and laser must be thoroughly explored. The system and primary deliveries are quickly learned. Much attention is paid to degraded system navigation and back-up weapons delivery. Finally, the new B/N "goes to the boat" to get his carrier qualification.

The extensive training in the RAG allows the new B/N to go to his Fleet Squadron with the ability and confidence to lead missions. He will often be crewed with a senior pilot and find himself tasked with the lead. The B/N's previous training and new experiences will be improved by practice and imagination, but must be tempered by discipline. The unpredictable combat environment, or rigorous training exercise, demands superior and totally professional performance.

Two minutes to the target. AAA is picking up and we are jinking and dispensing chaff. The cursors are in the general target area, an industrial complex. OAP (offset aimpoint) one selected; looks good. OAP two beginning to show now. Tune the radar. The hours spent drawing those radar predictions are really paying off. One minute to the target. The radar cursors are not on anything distinctive.

The FLIR shows the distinctive building we are after on the left; that's it! Step the computer into attack, laser on, elevation lock, az-range lock on, 10 seconds to release—BOMBS AWAY!!!

The culmination of the B/N's skill, imagination, training, discipline, and aggressiveness is the destruction of a difficult target. He has successfully navigated through rugged terrain and enemy defenses at night and in IFR conditions, found his target and destroyed it; every facet of the computer, inertial and weapons system is employed.

During the final portion of the target leg, the B/N is also extremely busy using the radar to its maximum capability. The normal PPI presentation is superb for navigation, but poor for bombing. An "expanded display" is available to allow precise cursor positioning. The area around the cursor intersection is expanded and fills the entire display. A very small area is presented in great detail. The B/N must fine tune the radar by using receiver, video and differential gain, slope and depth controls and the antenna tilt. He also narrows the sweep to get more "looks" at the target. The A-6 radar has an azimuth lock capability which will hold the cursors on the target if the INS has any velocity errors. An elevation lock feature accurately determines the vertical separation between target and aircraft, a critical value for accurate weapons delivery. This combination achieves an excellent "track-while-scan" capability for the A-6.

As the aircraft closes on the target, the B/N may transition to the FLIR. The FLIR can be degraded by weather, smoke or other obstructions. If the target is found on the FLIR scope, a "handoff" is accomplished. The FLIR provides considerably more accurate azimuth resolution than the radar. The B/N will also employ the laser so that precise ranging can be achieved. These functions can be accomplished even with the B/N in "the hood" by depressing various buttons on the slew stick. The radar scope and FLIR scope are covered by a hood to shield the ambient light from the display screens.

The armament control unit (ACU) was carefully set just after launch, and rechecked later in the flight. The ACU tells the computer what weapons are being delivered so that proper ballistics are used. It tells the computer what kind of attack will be made, how many bombs or rockets are to be used, and how far apart they should be spaced. The ACU also controls the fusing and is the interface between computer, weapon and air crew.

The A-6 crew can select one of five primary or four secondary attacks via the ACU. The primary attacks are horizontal straight path, a general dive toss, rocket, boresight and a high loft for nuclear weapons. Should the computer fail, the secondary attacks are used, which include straight path and loft type deliveries. Many other degraded options are available at the discretion of the B/N, depending on system status/reliability.

With five G's on the aircraft, we quickly turn to the south to escape the AAA and SAM threats and proceed to the coastline. Another A-6 has shut down the opposition radars with Standard ARM and Shrike missiles, facilitating our egress. Now if we can just find that "mobile runway," and its rolling, pitching deck. As we go "feet wet" and are relatively safe, a quick review of the VTR tape shows numerous secondaries in the target zone. It looks like we scored direct hits.

The ship gave us a projected position before launch, but ZIPLIP was also briefed. The weather is a little better; still rain and a low ceiling. Sure enough, the carrier was where she said she'd be, but eight other ships are in the formation. Climbing overhead, we find the KA-6 tanker and take on some fuel. Ten minutes before recovery time, the ship starts radiating her TACAN. The weather dictates an ACLS (Automatic Carrier Landing System) Mode I recovery. ACLS is a fully automated approach on final. The aircraft glide slope is calculated and adjusted by a computer on board the ship via the autopilot. Even deck motion is taken into account. A "hands off" approach can be flown.

As luck would have it, the ACLS gear just went down. Now we have to go back to the visual method and "fly the ball." I can back the CCA (Carrier Controlled Approach) up with a "landing mode" on our radar. The computer can generate symbology so that we shoot an internal GCA. I just have to keep the cursors on the stern of the ship. With the appropriate data entered, it should provide an excellent backup. We leave the approach fix exactly on the second and start our TACAN approach to the ship. Now my pilot has a slight case of vertigo. I will have to carefully monitor his approach and coach him whenever the airspeed, altitude, VSI, angle of attack, and line-up are not right. We "dirty up" at eight miles, still without a lock-up by the ship, pressing on our internal approach. Three quarters of a mile and still no ship so I call "507 CLARA," thereby informing the LSO (Landing Signal Officer) that we do not see the ship or a ball. The LSO replies "I hear you, keep it coming," as we break out of the overcast at exactly 200 feet. The dime-sized landing area is rapidly approaching and the deck is pitching and rolling in the heavy seas. "Left for line up," the LSO calls. "Watch your rate of descent. Lookin' good." Another night trap under the belt and my lifespan is shortened six months.

What does "B/N" stand for? More than just a bombardier or navigator. He is a copilot, mission commander, computer programmer, operator and trouble shooter. He is an irreplaceable part of team effort which gives the A-6 the well-deserved title of an all-weather, low-level, anytime, anywhere attack aircraft. He is an equal to the pilot with equal command opportunity, sharing as much or more responsibility for conducting a successful mission. He will eventually receive his own command if he successfully masters the many facets of being a top notch Naval Officer and Bombardier/Navigator, and demonstrates ability to lead and manage a squadron of A-6 Intruders.

Lt Lynch graduated from the US Naval Academy in 1978. After six-month duty as an Academy sailing coach, he completed flight training in 1979. Lt Lynch now serves with VA-75, stationed at NAS Oceana.

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